What is claimed is:

1. A method of nondestructive analysis of a test object, comprising:

a) activating a camera to capture an image of a test object, and transmitting said image to a memory of a computer,

b) altering a field of view of the camera, after the camera has completed step (a) but before the camera has acquired any further image,

c) re-activating the camera to capture another image of the test object, and transmitting said another image to the memory of the computer,

d) deforming the object,

e) repeating steps (a) through (c) while the object is deformed,

f) calculating an optical phase for each portion of each image, and

g) displaying an interference pattern representative of differences between optical phases of each image.

2. The method of Claim 1, wherein steps (a) through (c) are performed for a plurality of times.

3. The method of Claim 2, wherein steps (a) through (c) are repeated for a plurality of times while the object is undeformed and while the object is deformed.

4. The method of Claim 1, wherein steps (a) through (c) are performed four times, for both undeformed and deformed states of the object, and wherein step (g) includes calculating a phase for each pixel of a final image, according to the following equation:

$$\Delta(x,y) = \tan^{-1}\left[\frac{I_8(x,y) - I_6(x,y)}{I_5(x,y) - I_7(x,y)}\right] - \tan^{-1}\left[\frac{I_4(x,y) - I_2(x,y)}{I_1(x,y) - I_3(x,y)}\right].$$

where I_1 through I_8 are eight captured images given by:

$$I_1(x,y) = I'(x,y) + I''(x,y)\cos[\phi(x,y)],$$
$$I_2(x,y) = I'(x,y) + I''(x,y)\cos\left[\phi(x,y) + \pi/2\right],$$
$$I_3(x,y) = I'(x,y) + I''(x,y)\cos[\phi(x,y) + \pi],$$
$$I_4(x,y) = I'(x,y) + I''(x,y)\cos\left[\phi(x,y) + 3\pi/2\right],$$
$$I_5(x,y) = I'(x,y) + I''(x,y)\cos[\phi(x,y) + \Delta(x,y)],$$
$$I_6(x,y) = I'(x,y) + I''(x,y)\cos\left[\phi(x,y) + \Delta(x,y) + \pi/2\right],$$
$$I_7(x,y) = I'(x,y) + I''(x,y)\cos[\phi(x,y) + \Delta(x,y) + \pi],$$
$$I_8(x,y) = I'(x,y) + I''(x,y)\cos\left[\phi(x,y) + \Delta(x,y) + 3\pi/2\right]$$

wherein I' is a bias intensity, I'' is a modulation intensity, ϕ is a random phase variable due to diffuse reflection of light from the object, and Δ is a quantity directly proportional to differential displacement due to deformation.

5. The method of Claim 1, wherein the camera includes a shearography head comprising at least one translatable mirror, and wherein step (b) is performed by activating a piezoceramic disk connected to said mirror, wherein movement of the mirror causes a change in an image captured by the camera.

6. A method of nondestructive testing, comprising:

a) stepping a shearography camera through a plurality of video frames, each frame comprising an image of a test object, and storing each video frame,

b) repeating step (a) while the test object is deformed, and

c) generating an interference pattern representative of phase differences caused by deformation of the object,

wherein the camera is stepped between successive video frames.

7. The method of Claim 6, wherein the shearography camera includes a Michelson interferometer having at least one movable mirror, and wherein step (a) comprises moving said mirror through a predetermined distance.

8. The method of Claim 7, wherein the mirror is connected to a piezoceramic disk, and wherein step (a) comprises transmitting an electrical signal to said disk so as to cause movement of the mirror.

9. A portable real-time high-resolution digital phase-stepped shearography apparatus comprising:

a) a shearography head including at least one movable mirror and a piezoceramic disk connected to the mirror,

b) a programmed computer connected to said shearography head, and

c) a display, connected to the computer,

wherein the computer is programmed to issue signals to the piezoceramic disk so as to control movements of the mirror, and wherein the computer is programmed to store images of a test object captured by the shearography head, and to analyze said images so as to produce an interference pattern viewable on the display.

10. The shearography apparatus of Claim 9, wherein the computer comprises means for moving the mirror only while the shearography head is not acquiring an image.

11. The shearography apparatus of Claim 9, wherein the shearography head is mounted in an enclosure, and wherein the enclosure also includes at least one excitation mechanism for causing deformation of a test object.

12. The shearography apparatus of Claim 11, wherein the enclosure includes at least two distinct excitation mechanisms.

13. The shearography apparatus of Claim 10, wherein the shearography head is mounted in an enclosure, and wherein the enclosure also includes at least one excitation mechanism for causing deformation of a test object.

14. The shearography apparatus of Claim 13, wherein the enclosure includes at least two distinct excitation mechanisms.

15. The shearography apparatus of Claim 9, wherein the shearography head includes a high-resolution video camera.

16. A portable real-time high-resolution digital phase-stepped shearography apparatus comprising:

a) a shearography head including a high-resolution video camera and a Michelson interferometer including at least one movable mirror and a piezoceramic disk connected to the mirror,

b) the shearography head being connected to a housing, wherein the housing supports at least one excitation mechanism,

c) a programmed computer connected to said shearography head, and

d) a display, connected to the computer,

wherein the computer is programmed to issue signals to the piezoceramic disk so as to control movements of the mirror, and wherein the computer is programmed to store images of a test object captured by the shearography head, and to analyze said images so as to produce an interference pattern viewable on the display.

17. The shearography apparatus of Claim 16, wherein the computer comprises means for moving the mirror only while the shearography head is not acquiring an image.

18. The shearography apparatus of Claim 16, wherein the housing comprises an enclosure having a top, the shearography head being mounted on the top of the enclosure, the enclosure including at least one mirror and a window.

19. The shearography apparatus of Claim 18, wherein the enclosure has a hole which cooperates with a second hole in the shearography head, wherein light can pass from the head, to the object, and back into the head.

20. The shearography apparatus of Claim 16, wherein the housing

supports at least two distinct excitation mechanisms.

21. A portable real-time high-resolution digital phase-stepped shearography apparatus comprising:

a) a shearography head including a high-resolution video camera and a Michelson interferometer including at least one movable mirror and a piezoceramic disk connected to the mirror,

b) the shearography head being mounted on an exterior surface of a housing, wherein the housing includes at least two distinct excitation mechanisms, the excitation mechanisms being adapted to cause deformation of a test object,

c) a programmed computer connected to said shearography head, and

d) a display, connected to the computer,

wherein the computer is programmed to issue signals to the piezoceramic disk so as to control movements of the mirror, and wherein the computer is programmed to store images of a test object captured by the shearography head, and to analyze said images so as to produce an interference pattern viewable on the display.

22. The shearography apparatus of Claim 21, wherein the computer comprises means for moving the mirror only while the shearography head is not acquiring an image.

23. A method of nondestructive testing of an object, comprising:

a) aiming a portable shearography unit at a test object, the shearography unit including a shearography head, and at least one excitation mechanism, the shearography unit being connected to a computer and a display,

b) activating the shearography head to acquire images of the test object while the object is in an undeformed state,

c) actuating the excitation mechanism so as to deform the object,

d) activating the shearography head to acquire images of the test object while the object is in a deformed state,

e) processing the images acquired in steps (b) and (d) in the computer so as to generate an interference pattern on the display.

24. The method of Claim 23, wherein steps (b) and (d) include stepping the shearography head through a plurality of distinct fields of view, and wherein the stepping is performed only between successive images.

25. The method of Claim 24, wherein the stepping is performed by transmitting signals to a piezoceramic disk connected to a mirror in the shearography head so as to move the mirror through a predetermined distance.